

Research Studies

EngrTEAMS Project Research Question:

What are the effects of engineering design pedagogies and curricula combined with a strong coaching model on student learning in science, data analysis, measurement, process skills, and critical thinking?

Study 1:

Student Achievement

In what ways does participation in STEM integration curriculum affect students' content and process knowledge in the STEM disciplines?

Study 2:

Argumentation

How does STEM integration curriculum support teachers in their practice of using argumentation? What are the effects of teaching with argumentation on students' abilities to think critically?

Study 3:

Coaching

How does working with a coach/mentor impact commitment to and implementation of targeted practices? How do coaches/mentors inform teachers' instructional decision-making? How do collaboratively-developed goals change as the teacher-coach relationships develops? What is the impact of the experience on coaches?

Study 4:

Curriculum Development

In what ways do teachers approach the design and implementation of the STEM integration curriculum modules? After participation in STEM integration curricular units, in what ways do students engage in STEM habits of mind, and what is their disposition towards engaging in STEM-related activities and learning practices with others?



Curricular Units Developed by EngrTEAMS Fellows

Earth Science

Ford Park Restoration:

The Mississippi River Fossil Foundation has outlined criteria for an outdoor functional area to be designed by local community members. In this unit, students address this challenge using information they have collected about human impact on the Mississippi River environment. They are tasked with designing a park that promotes outdoor recreational activities while at the same time preserves the Mississippi's natural features. Students share a planned persuasive presentation to convince the foundation to choose their park design.

Life Science

Loon Nesting Platforms:

The Loon is the state bird of Minnesota. Through construction of loon nesting platforms, students learn about ecology and ecosystems. After completing their designs, students will draw upon their knowledge of loon habitats, dietary needs, food chains and food webs, and predator/prey relationships redesign and make an educated decision as to where to place their platform.

Physical Science

Desalination:

Clean drinkable water is a necessity for life on this planet. Although the entire earth is surrounded by water, only 3% is fresh water. Students will be challenged with the task of developing and building a portable filtration and desalination device that purifies "dirty," salty water and makes the water safe for drinking. Using multiple labs and activities, students will explore the physical properties of matter including phases of matter and solubility.



Engineering to Transform the Education of Analysis, Measurement, and Science in a Team-Based Targeted Mathematics-Science Partnership

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STEM Integration Framework

Designed by EngrTEAMS PIs, Dr. Tamara Moore and Dr. Selcen Guzey, the STEM integration framework is the foundation for the research and professional development conducted on the EngrTEAMS project.

The STEM Integration Framework designates high quality STEM integration learning experiences for students as having the following requirements...

Have a personally meaningful, motivating, and engaging **CONTEXT**

Have learners participate in an **ENGINEERING DESIGN** task for a compelling purpose that involves problem-solving skills and ties to context

Allow learners to **LEARN FROM FAILURE** and then have the opportunity to **RE-DESIGN**

Include appropriate, standards-based science and/or mathematics **CONTENT**

Teach content with **STUDENT-CENTERED** pedagogies

Promote **COMMUNICATION** skills and **TEAMWORK**

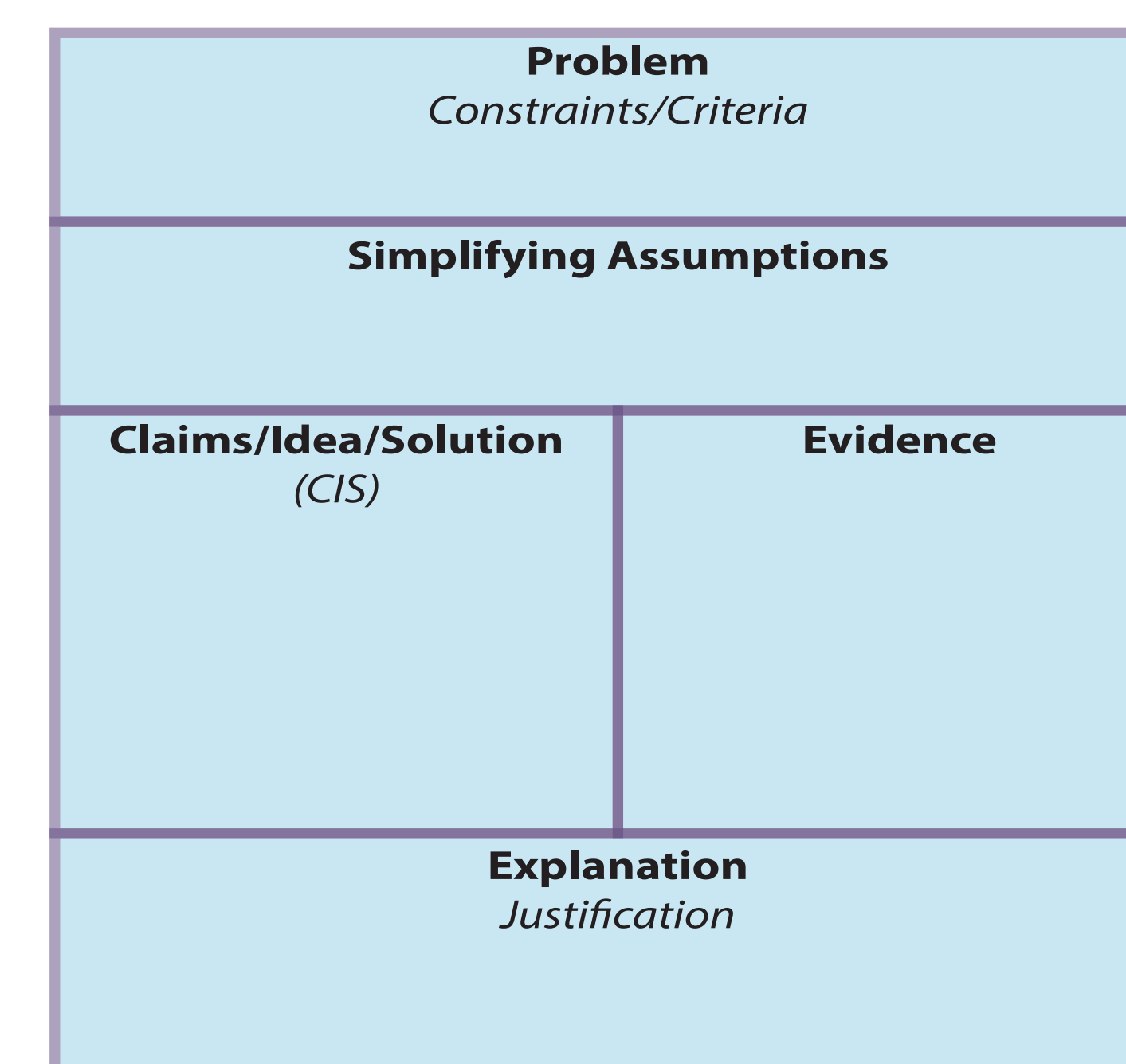
Thread the **ENGINEERING** and **CONTEXT THROUGHOUT** the experience, not just at the beginning and end.

Engage students in **EVIDENCE-BASED REASONING** to integrate the subjects.



Evidence-Based Reasoning

Designed to support the STEM Integration Framework, this tool has been used in the EngrTEAMS professional development and integrated into participants' classrooms.



For More Information Visit
www.engrteams.org

Purpose

This project is designed to help 200 teachers develop engineering design-based curricular units for each of the major science topic areas within the Minnesota State Academic Science Standards, as well as data analysis and measurement standards for grades 4-8. With a focus on vertical alignment and transition from upper elementary to middle-level, this project will impact at least 15,000 students over the life of the grant.

Measurable Outcomes

- Increase student mastery of grade-level standards in science and data analysis/ measurement

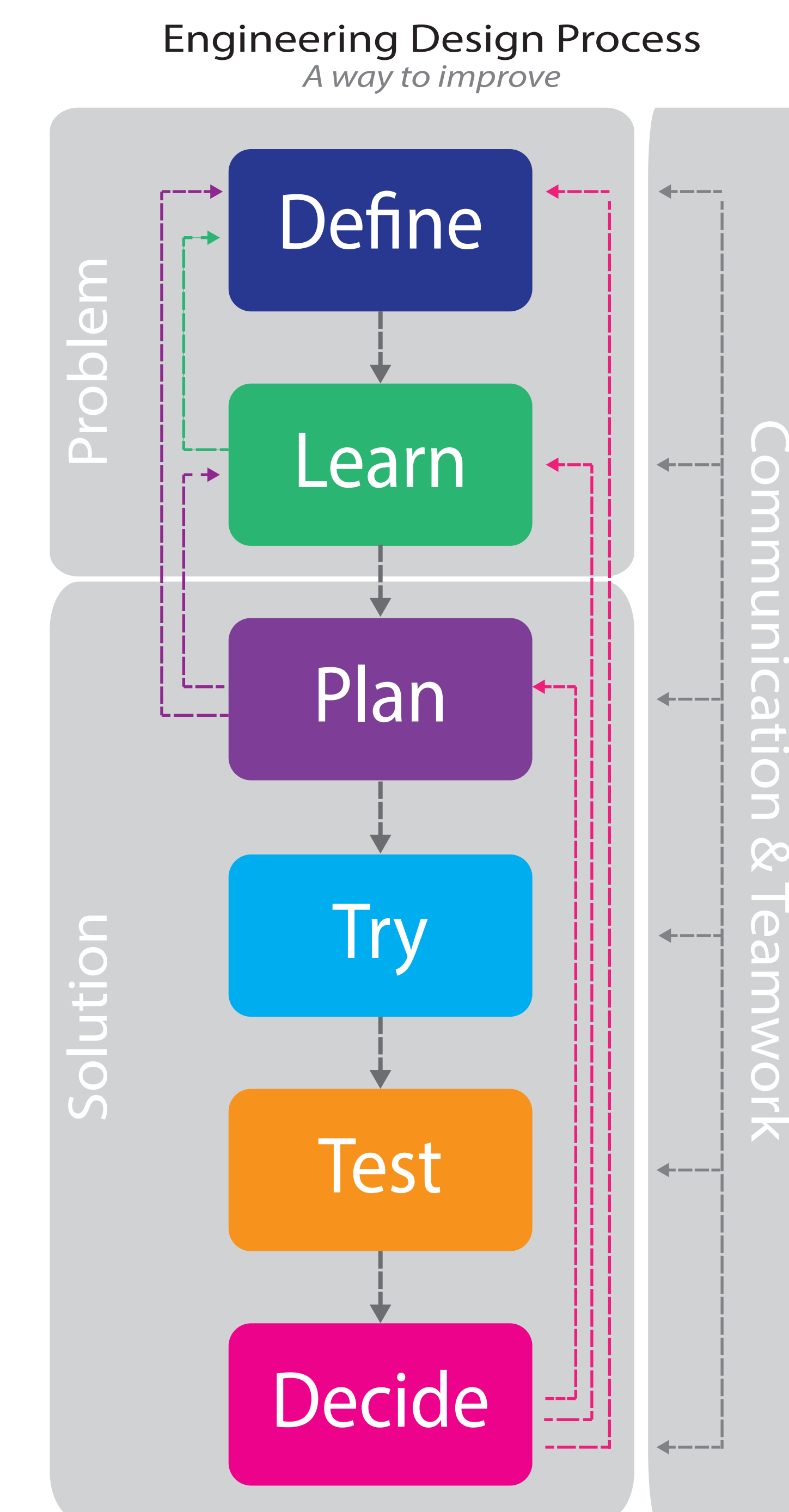
- Increase student understanding of engineering and engineering design

- Promote a coherent transition between intermediate and middle school science learning through aligning the curricula for developmentally appropriate learning of concepts and aligning the pedagogies for research-based learning opportunities for students

- Develop an effective and sustainable model to support STEM integration in science learning environments

- Promote curricular design that allows content to be taught more meaningfully in the same or less time as more typical ways of approaching the teaching of science

Engineering Design Process



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This tool was designed by the Lead PI, Tamara Moore for a separate NSF funded grant EEC-1442416 and has been used in both projects to guide participants through the Engineering Design Process and has been implemented in many participants' classrooms.

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